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RESULTS FROM PLEGPAY EXPERIMENT ON THE ISS

Abstract

The PLEGPAY experiment (PLASMA CONTACTOR ELECTRON GUN PAYLOAD) has flown on board the ISS from February 2008 till September 2009, accommodated on the European Technology Exposure Facility (EuTEF) externally mounted to the Columbus module, and operated from the Erasmus User Support and Operations Centre (USOC) in Noordwijk, the Netherlands. The main objective of the PLEGPAY experiment on the ISS was plasma contactor technological validation, through extensive in-flight operation in the actual ionospheric environment. The scientific objective of the PLEGPAY experiment is the study of the spacecraft/space environment interactions, with reference to electrostatic charging/discharging phenomena. The electrical neutrality of a large space structure is a fundamental requirement to avoid discharges and, in general, problems during space operations like Extra Vehicular Activities (EVA) and dockings/undockings, which are of primary importance for the survival, servicing and development of the space infrastructure itself. This concept is applicable to satellites as well. Among the existing active methods to mitigate charging effects, the hollow cathode plasma contactor (an electric propulsion spin-off technology) has been selected for space testing. PLEGPAY operations onboard the ISS confirmed the effectiveness of PC operation, even impacting (by experiment)the ISS floating potential. This paper will address the scientific results of the PLEGPAY experiment and will also give some insight in the operational difficulties experienced due to the ISS safety concerns. Besides the PC, PLEGPAY is also equipped with diagnostic equipment (i.e. a Langmuir Probe).Joint analyses have been performed with the NASA/Boeing FPMU in order to compare/coordinate diagnostics measurements. An experiment like PLEGPAY (i.e. a biased PC) has never been operated before on the ISS and unfortunately, due to the safety issues, PLEGPAY could not exploit its full capabilities and could not meet its mission objectives. However, NASA and the ISS Space Environments Team would in principle be interested in an experiment re-flight using refurbished PLEGPAY hardware, provided that a more safe approach is studied and implemented, including a protocol for the experiment operation and a number of inhibits in case an experiment run has to be stopped. In fact, according to the understanding of Thales Alenia Space, the topics related to ISS potential vs. ionospheric plasma are still subject to further research by NASA and the ISS Space Environments Team, and availability of experimental data would be of benefit to complement the performed studies and the available models.